Rail Twirler

GYR-275

A retro toy... and so much more!

The Rail Twirler is one of those wonderful "toys" that can mesmerize AND teach at the same time.

With a flick of the wrist, you can demonstrate the conversion of potential energy to kinetic energy and back again. Simply tip the toy upward or downward to set the magnetic wheel in motion along the metal rails.

That's all it takes to get the wheel—and the questions—rolling!

How does it work?

You will marvel at how simple the Rail Twirler is. There is a plastic wheel with built-in magnets on the ends, and a set of metal tracks upon which the wheel can travel. As the track is tilted up and down, the wheel rolls the length of the track, top and bottom, and then again on the opposite side of the wire.

In this way, the wheel always keeps in contact with the track, and can be continually propelled on its cyclical course. With proper timing, the wheel can be brought to a great speed.

Preview the Rail Twirler in action:

Our YouTube channel includes a video explaining how the Rail Twirler can be used to explain potential and kinetic energy:

www.youtube.com/watch?v=U-aX1S73DQw

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Demonstrating the Rail Twirler

1. Hold the Rail Twirler vertically with the wheel at the base. Point out to students that the wheel is at its lowest position on the rail. In this position, it has no potential energy.

2. Keeping the toy vertical, slide the wheel to the top of the rail and hold it there. Explain that by doing this small amount of "work," you have added potential energy to the wheel.

3. Ask students how high they think the wheel will return if you simply let the wheel go and allow it to "fall" without moving the rails.

4. When you release the wheel, gravity will pull it downward. As the potential energy decreases, the kinetic energy increases. On its first circuit, the wheel almost returns back to the top—but it doesn't quite make it.

5. Be sure to point out to students that, with each successive circuit around the rails, the wheel doesn't travel quite as high as the last time. Unless you add more energy to the process, eventually the wheel will stop entirely. If energy cannot be created or destroyed, then where does that energy go? *(It is transferred out to heat, sound, and friction.)*

The Law of Conservation of Energy states that energy cannot be created or destroyed, but only changed from one form into another or transferred from one object to another.

Discussing the Rail Twirler

With the Rail Twirler, you can start discussions on a wide range of science topics. For instance:

- ✓ **Potential and Kinetic Energy:** At what points along the rail does the wheel have the greatest amount of potential energy? Kinetic energy?

- ✓ **Motion:** After the wheel is set in motion, what can you do to alter its speed? Challenge students to see who can get the wheel spinning the fastest… or for the longest time without stopping. How do their variations relate to Newton's First Law ("Every object will remain at rest or in uniform motion in a straight line unless compelled to change its state by the action of an external force")?

- ✓ **Conversion of Energy:** **The Law of Conservation of Energy** states that energy cannot be created or destroyed, but only changed from one form into another or transferred from one object to another. Unless you continue to add energy to the circuit, the wheel will eventually slow down and come to a stop. Ask students to trace the energy—where has it gone? What is the original energy converted into? *(Answer: heat, vibration and sound energy.)*

- ✓ **Magnetism:** What role do the magnets play in the Rail Twirler's function? How much of the wheel's motion can be attributed to the magnets? Do the magnets affect the wheel's speed? Would the toy work equally well if it were able to travel along the rails without magnets?

- ✓ **Gravity:** What role does gravity play in the wheel's motion? What happens when you tilt the toy so that the wheel is not relying on gravity to move? How do you think this toy would work in outer space (in a zero gravity environment)?

- ✓ **Optical Illusions:** Instruct students to create cardboard cut-out discs that can be decorated with simple black-and-white designs and attached to the wheel. What happens when the wheel spins? Do certain designs work better than others to create optical illusions? How does the human eye (and brain) make sense of optical illusions? What does "persistence of vision" mean, and how does it relate to the Rail Twirler?

Take Your Lesson Further

As science teachers ourselves, we know how much effort goes into preparing lessons. For us, "*Teachers Serving Teachers*" isn't just a slogan—it's our promise to you!

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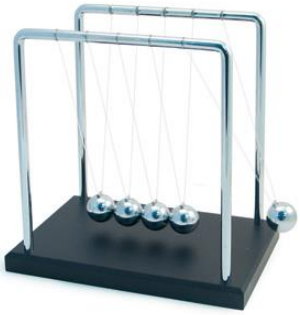
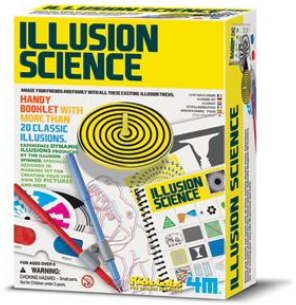
To extend your lesson, consider these Educational Innovations products:



Newton's Cradle (NEW-100)

Find hours of entertainment in this chic, easy to assemble Newton's Cradle! Perfect for teaching your students about Newton's laws of motion, Newton's Cradle makes a great addition to any classroom.



Illusion Science (GRN-430)

Everyone loves optical illusions. This kit gives students a chance to perform over 20 optical illusion experiments—including the classic morph illusion and Benham disk—and learn about the science behind them. A specially designed 3D marker set is provided for creating 3D pictures, as well as 3D glasses, a carrying pouch, and more.

Magnetic Accelerator (MAG-400)

Place three seemingly identical spheres on a 1-meter horizontal track touching each other. Roll another sphere slowly into the spheres at rest. Wow! All of a sudden, the last sphere takes off with tremendous velocity. The system seems to have gained energy! Could this be the basis of a perpetual motion machine? Hmm... Great for open-ended discovery! Six additional spheres for additional experimentation are also available. (MAG-415)
